Wildlife Services

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National Wildlife Research Center

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Reducing Avian Predation in Aquaculture Systems

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Major Cooperators:

- Canadian Wildlife Service
- Catfish Farmers of America
- Cornell University
- Delta Research and Extension Center, Thad Cochran National Warmwater Aquaculture Center
- Michigan Department of Natural Resources
- Mississippi Agricultural and Forestry Experiment Station
- Mississippi State University, College of Veterinary Medicine
- Mississippi State University, Department of Wildlife, Fisheries, and Aquaculture
- Ontario Ministry of Natural Resources
- Ontario Parks
- Southern Regional Aquaculture Center
- Vermont Fish and Game Department
- Wildlife Services Operations

Groups Affected by These Problems

- Catfish Farmers
- Aquaculture producers, distributors and retailers
- Consumers
- Sportfish guides and outfitters
- Wildlife managers

National Wildlife Research Center Scientists Address Aquaculture Losses

Wildlife Services' (WS) National Wildlife Research Center (NWRC) is the only Federal research facility devoted exclusively to resolving conflicts between people and wildlife through the development of effective, selective and socially responsible methods, tools, and techniques. The NWRC's field station in Starkville, Mississippi, is located in the heart of the primary aquaculture producing area of the southeastern U.S. and was established to develop methods to reduce the impacts of fish-eating birds on aquaculture stocks.

In the past 35 years, populations of fish-eating birds have increased dramatically and caused substantial economic impacts on aquaculture production. Aquaculture industry costs associated with bird damage and damage prevention are estimated to exceed $25 million annually. The goal of NWRC's research is to determine the economic impact of fish-eating birds on aquaculture production and natural resources and to develop methods to reduce depredation impacts on southeastern catfish, baitfish, and crawfish industries. Current research is aimed at gaining information about the abundance, distribution, and foraging behavior of fish-eating birds; economic impacts associated with their foraging activities; and diseases they transmit at aquaculture facilities. Information gathered as a consequence of this research provides a basis for developing new strategies, techniques, and tools for reducing damage.

Applying Science and Expertise to Wildlife Challenges

Population Trends of Fish-Eating Birds—NWRC scientists are using telemetry and banding techniques to track large-scale movements, population trends, and demographics of double-crested cormorants and American white pelicans. Satellite telemetry data reveal cormorants migrate to two key wintering locations. Western populations winter mainly in the lower Mississippi alluvial valley and eastern populations winter in the U.S. Atlantic States. This research will be used to evaluate various alternatives for managing impacts of these species on commercial and natural resources.

Cormorant Damage to Catfish Aquaculture—The U.S. catfish industry is valued at more than $572 million per year in processed product sales, with over 50 percent of catfish production originating from Mississippi. NWRC biologists recently completed a decade-long field study that utilized data on cormorant food habits, bioenergetics, distribution, and abundance to evaluate cormorant impacts on catfish aquaculture. Cormorants used catfish ponds extensively from January through April, with the greatest economic damage occurring in February and March. During the study, between 1,347 and 1,775 metric tons of catfish were consumed by cormorants in the Delta region of Mississippi. This depredation translated into a loss to the industry of $5.6 to $12.0 million annually or approximately 2-5 percent of gross farm sales.

Cormorant Movements—NWRC scientists used satellite telemetry to evaluate movements and migration patterns of double-crested cormorants captured near southeastern catfish aquaculture ponds. Results demonstrated that cormorants migrated along the Mississippi, Missouri, and Ohio River Valleys. The average duration of spring migration was 12 days. During this period the cormorants traveled an average of 43 miles/70 kilometers per day. These data indicate that cormorants tend to stay in one general region throughout winter if adequate food resources are available and their roosting sites are undisturbed, providing further evidence that aquaculture is utilized extensively by wintering cormorants. Catfish farmers, aquaculturists, and resource managers are using these data to more efficiently refine the timing of and resources devoted to cormorant management activities.

Cormorant Breeding Colony Dynamics—NWRC scientists and partners conducted a long-term study of cormorant breeding colony dynamics in the Great Lakes. This research

was a cooperative effort involving Mississippi State University, the Canadian Wildlife Service, Ontario Ministry of Natural Resources, Ontario Parks, and Trent University. Survival estimates indicate approximately 80 percent mortality for first year birds, decreasing to over 20 percent thereafter. These data indicate some regional differences in reproductive parameters and suggest that management decisions should be based on local or regional population information. Population models reveal that a combination of adult culling and egg oiling would have the greatest efficacy for reducing population growth.

Aging Cormorants—NWRC scientists and collaborators at West Virginia University have identified a biomarker in the skin that is a predictor of age in double-crested cormorants. This information may lead to a rapid technique for identifying age of cormorants and many other species of birds without the need for more costly and logistically difficult methods. This technique will help quantify the demographics of cormorant populations, thus allowing for the optimization of management strategies for maintaining population viability while minimizing damage.

Cormorant Diet—NWRC scientists used fatty acid profiles to distinguish between game fish and farm-raised channel catfish in the fatty tissue of double-crested cormorants. Results indicated that it may be possible not only to distinguish between farm-raised channel catfish and game fish in the diet of cormorants, but also to identify the sources of the farm-raised channel catfish in the diet. Biologists and chemists are continuing to investigate the possibility of using fatty acid profiles to assess the actual impact of fish-eating birds on catfish aquaculture and recreational fisheries.

Harassment of Cormorants—NWRC scientists evaluated the utility of harassment programs involving spring migrating cormorants for reducing predation on vulnerable spawning stocks of walleye and yellow perch at two locations in Michigan. Overall harassment deterred 90 percent of cormorant foraging attempts, with an average of less than 6 percent of the cormorants taken lethally at each site. Both walleye and yellow perch abundance increased significantly at each location. These results support the hypotheses that cormorant predation on spawning aggregations of sportfish is a significant mortality factor, and that cormorant management can reduce sportfish mortality and increase fish abundance. Continuation of cormorant harassment programs and fishery assessments will determine whether improvement of targeted sport fisheries is sustained.

American White Pelican Disease Ecology—In collaboration with parasitologists at Mississippi State University College of Veterinary Medicine, the Thad Cochran Warmwater Aquaculture Center, and the Southern Regional Aquaculture Center, NWRC scientists described the life cycle for a virulent species of trematode infecting catfish in the southeastern U.S. and confirmed that American white pelicans serve as a host for this parasite. Results indicated that American white pelicans can transmit this parasite among catfish ponds. Double-crested cormorants, great blue herons, and great egrets did not appear to serve as hosts for these trematodes. Parasite life-cycle studies indicate that even low infection of trematodes in pelicans can result in large numbers of trematode eggs deposited into catfish ponds. In addition, NWRC scientists confirmed that an introduced species of snail can serve as an intermediate host to the parasite. These studies underscore the importance of preventing pelican use of aquaculture facilities and understanding the biology and epidemiology of the disease organism.

Management Activites at Cormorant Nesting Colonies—Large colonies of double-crested cormorants breed in the Les Cheneaux Islands region of Lake Huron, Michigan. NWRC scientists and colloborators evaluated the effectiveness of WS cormorant management as a means of improving the local yellow perch fishery. Management activities included egg-oiling to prevent reproduction and culling of some birds. Research documented an 83 percent decline in the number of cormorant foraging attempts and an increase in yellow perch and walleye abundance at locations where these management activities were in place. Management also resulted in reductions of over 90 percent in the annual numbers of young cormorants produced and 70 percent in the total cormorant population.

Great Egrets as Vectors for *Aeromonas hydrophila* (VAH) Among Catfish Ponds—Recent severe disease outbreaks in channel catfish aquaculture have been associated with a highly virulent strain of the bacterium VAH. Given that VAH is known to infect birds, NWRC researchers hypothesized that fish-eating birds may serve as a reservoir for VAH and spread the pathogen from pond to pond. NWRC researchers conducted experimental studies that showed that great egrets that were fed VAH-infected catfish excrete viable VAH. Shedding occurred up to two days after the birds were switched to a non-infected fish diet. At necropsy on day seven, nasal swabs from two great egrets were VAH-positive. Great egrets show strong potential as vectors for VAH transmission to catfish ponds. Furthermore, the VAH colonization of the birds' nasal passages indicates that fish-eating birds could serve as a reservoir for the pathogen.

Selected Publications:

DORR, B. S., S. L. HANISCH, P. H. BUTCHKO, and D. G. FIELDER. 2012. Management of double-crested cormorants to improve sport fisheries in Michigan: 3 case studies. Human-Wildlife Interactions 6:140-153.

DORR, B. S., L. W. BURGER, S. C. BARRAS and K. GODWIN. 2012. Double-crested Cormorant distribution on catfish aquaculture in the Yazoo River Basin of Mississippi. Wildlife Society Bulletin 36: 70-77.

KING, D.T., B.K STRICKLAND, AND A. RADOMSKI. 2012. Winter and summer home ranges and core use areas of double-crested cormorants captured near aquaculture facilities in the southeastern United States. Waterbirds 35 (Special Publication 1): 124-131.

KING, D.T., B.K STRICKLAND, AND A. RADOMSKI. 2012. Migration patterns of double-crested cormorants wintering in the southeastern United States. Waterbirds 35 (Special Publication 1): 132-137.

FERGUSON, T. L., B. J. RUDE, and D. T. KING. 2011. Nutrient utilization and diet preference of American white pelicans consuming either a mono- or multi-species diet. Waterbirds. 34: 218-224.

GUILLAUMET, A., B. DORR, and G. WANG. 2012. Towards optimized population control efficiency in space and time: A modeling framework adapted to a colonial waterbird. Ecological Modeling 235-236:95-101.

GUILLAUMET, A., B. S. DORR, G. WANG, J. D. TAYLOR III, R. B. CHIPMAN. H. SCHERR, J. BOWMAN, K. F. ABRAHAM, T. J. DOYLE, and E. CRANKER. 2011. Determinants of local and migratory movements of Great Lakes double-crested cormorants. Behavioral Ecology 22:1096-1103.

HANSON, K. C., T. L. DEVAULT, and S. J. DINSMORE. 2010. Increased abundance and first breeding record of the neotropic cormorant on the alluvial plain of Mississippi. Southeastern Naturalist 9:385-394.

KING, D. T., B. F. BLACKWELL, B. S. DORR, J. L. BELANT. 2010. Effects of aquaculture on migration and movement patterns of double-crested cormorants. Human-Wildlife Conflicts 4:77-86.

Major Research Accomplishments:

- WS research showed double-crested cormorants tend to stay in one general region throughout winter if adequate food resources are available and their roosting sites are undisturbed. These data provide further evidence that aquaculture provides an ideal environment for wintering cormorants.
- WS and collaborators identified a biomarker in the skin of double-crested cormorants that is a predictor of age.
- WS research showed fatty acid profiles developed from cormorant fatty tissues can distinguish between game fish and farm-raised channel catfish in the diet of cormorants.
- WS and their cooperators demonstrated that American white pelicans are a host of the Bolbophorus trematode, which can be devastating to the catfish aquaculture industry.
- WS research documented a large decline in numbers of double-crested cormorant foraging attempts, and an increase in walleye populations at lakes in Michigan as a result of an ongoing cormorant management program.
- WS and their cooperators demonstrated that great egrets show strong potential as vectors for the transmission of a virulent strain of Aeromonas hydrophila to catfish farms.